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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/872,203	05/31/2001	Yeong-Kwan Kim	2522-11	1930

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EXAMINER

MALDONADO, JULIO J

ART UNIT PAPER NUMBER

2823

DATE MAILED: 10/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/872,203

Applicant(s)

KIM ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 32-35, 37 and 38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In reference to claim 32-35, 37 and 38, applicants recite that the single atomic layer is an "oxide layer" (claim 32), a "composite oxide layer" (claim 33), a "nitride layer" (claim 34), a "complex nitride layer" (claim 35), a "silicide layer" (claim 37) and a "silicate material" (claim 38). This renders the claim indefinite since, according to independent claim 27, the single atomic layer comprises a metal. In regard to the term atomic layer meaning a metal layer, although the applicant can be its own lexicographer, the term conflicts with the general meaning in the art, since atomic layer usually means an extremely thin layer of a few angstroms (1-10Å) and a metal layer can be of any thickness. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 2, 8, 40 and 41 are rejected under 35 U.S.C. 102(b) as being anticipated by Hyun et al. (U.S. 6,042,652).

Hyun et al. (Fig.3) in a related method to deposit a thin film using atomic layer deposition (ALD) teach the steps of providing a reactor (120) having a single reaction space; loading a plurality of wafers (122) having a processing surface into the reaction space, wherein the processing surfaces of the wafers (122) face in substantially the same direction and said loading comprises transferring the batch of substrates (122) using an automatic wafer transport mechanism (102); introducing a first reactant into the reaction space, wherein a portion of the first reactant is chemically adsorbed on the processing surface of each of the plurality of wafers (122); diluting a non-chemically adsorbed portion of the first reactants in the single reaction space; removing a non-chemically adsorbed portion of the first reactant from the reaction space; introducing a second reactant into the reaction space, wherein a portion of the second reactant is chemically adsorbed on the processing surface of each of the plurality of wafers (122); diluting a non-chemically adsorbed portion of the second reactants in the single reaction space; removing a non-chemically adsorbed portion of the second reactant from the reaction space (column 4, line 24 – column 8, line 14); and repeating any of the steps (column 1, line 65 – column 2, line 5).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 3-7 and 9-26 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Hyun et al. ('652).

In reference to claims 3, 6, 9, 12, 16, 21, 23 and 25, Hyun et al. (Fig.3) in a related method to deposit a thin film using atomic layer deposition (ALD) teach the steps of providing a more than one hundred semiconductor substrates (122) into a reactor (120); introducing a gas containing reactants into the reactor (120) at a first pressure, and chemically adsorbing a portion of the reactants on the substrate surface; diluting non-chemically adsorbed reactants in the single reactor (120); and removing the diluted non-chemically adsorbed reactants from the reactor (column 4, line 24 – column 8, line 14).

Hyun et al. fail to teach that diluting the non-chemically adsorbed reactants in the inert gas raises the pressure to a second pressure and that removing the diluted non-chemically adsorbed gases reduces the pressure to a third pressure. However, the total pressure of a gaseous system (i.e. the reactor) is directly proportional to the amount of gas. Therefore, adding or removing gas from the reactor raises or reduces the pressure, respectively. Hyun et al. inherently teach pressure changes by adding or removing gas from the reactor.

In reference to claims 4, 5, 7, 10, 11, 13, 19, 20 and 22, Hyun et al. substantially teach all aspects of the invention but fails to show that the first pressure is between approximately 0.1 Torr and approximately 0.5 Torr; that the second pressure is approximately 1.5 times the first pressure; and that the third pressure is approximately 0.5 lower than the first pressure. However, the selection of the claimed ranges is

obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

In reference to claims 14, 15, 17, 18, Hyun et al. teach the reactor (120) includes a pressure control valve connected to an exhaustion line for removing the diluted non-chemically adsorbed reactants and said diluting comprise substantially closing the control valve and supplying an inert gas into the reactor while substantially stopping the introduction of the gas containing reactants into the reactor (120) (column 4, line 24 – column 8, line 14).

In reference to claims 24 and 26, Hyun et al. teach that the reactor (120) is a furnace-type reactor and has a single space; and that the top surfaces of the substrates (122) face in the same direction for automated wafer transfer (column 4, line 24 – column 8, line 14).

7. Claims 27-31, 36 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hyun et al. ('652) in view of Soininen et al. (U.S. 2002/0004293 A1).

In reference to claims 27, 36 and 39, Hyun et al. (Fig.3) in a related method to deposit a thin film using atomic layer deposition (ALD) teach the steps of providing a reactor (120) having a single reaction space; loading a plurality of semiconductor wafers (122) having a processing surface into the reaction space, wherein the processing surfaces of the wafers (122) face in substantially the same direction and said loading

comprises transferring the batch of substrates (122) using an automatic wafer transport mechanism (102); introducing a first gaseous reactant into the reaction space at a first pressure, wherein a portion of the first reactant is chemically adsorbed on the processing surface of each of the plurality of wafers (122); diluting non-chemically adsorbed first reactants in the reactor (120) by injecting an inert gas into the chamber; removing non-chemically adsorbed first reactant from the chamber; introducing a second gaseous reactant into the reactor (120) at a second pressure, wherein a portion of the second reactant is chemically adsorbed on the processing surface of each of the plurality of wafers (122); diluting a non-chemically adsorbed portion of the second reactants in the single reaction space; removing a non-chemically adsorbed portion of the second reactant from the reaction space (column 4, line 24 – column 8, line 14); and repeating any of the steps (column 1, line 65 – column 2, line 5).

Hyun et al. fail to teach that diluting the non-chemically adsorbed reactants in the inert gas raises the pressure to a second pressure and that removing the diluted non-chemically adsorbed gases reduces the pressure to a third pressure. However, the total pressure of a gaseous system (i.e. the reactor) is directly proportional to the amount of gas. Therefore, adding or removing gas from the reactor raises or reduces the pressure, respectively. Hyun et al. inherently teach pressure changes by adding or removing gas from the reactor.

Still, Hyun et al. fail to teach the second deposited layer is a single atomic metal layer formed by chemical exchange, wherein said metal layer comprises copper. However, Soininen et al. in a related method to use atomic layer deposition teach

depositing a single atomic metal layer by chemical exchange, wherein said metal layer comprises copper ([0045]-[0046]). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form a metal layer as taught by Soininen et al. in the ALD process of Hyun et al., since this process would provide structural integrity of the metal and avoid pinholes ([0047]).

In reference to claims 28-31 Hyun et al. in combination with Soininen et al. substantially teach all aspects of the invention but fail to show that the reactor pressure increases not less than 1.5 times the first and second pressure during the diluting with the inert gas and that the third pressure is substantially lower than either first or second pressure. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

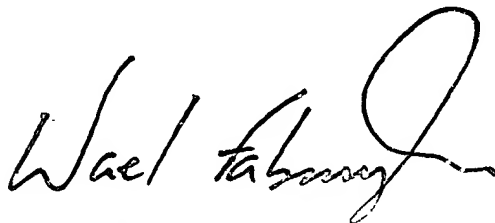
Conclusion

Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

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